

# NASA TECH BRIEF



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## Vibration Testing and Dynamic Studies of Relays

A study has been undertaken to determine the separation criteria for a preloaded, idealized set of contacts when they are subjected to a steady-state sinusoidal excitation and when the elasticity of one contact is nonlinear. The study consists of two phases; theoretical and experimental.

The set of contacts is taken as a two-mass, two-spring system with one nonlinear spring of the Duffing hardening type. With arbitrary system parameters, such a system represents a variety of contact configurations. A linear system is represented by the special case where the nonlinear coefficient becomes zero.

The contact set is idealized by assuming lumped parameters; that is, massless springs and springless masses. The contact preload is assumed without regard to its origin.

Separation criteria are determined for the contact set under the assumption of negligible damping. The point of impending contact separation is a point of transition from a single degree-of-freedom system to a two degree-of-freedom system. Consequently, it is only necessary to consider the single degree-of-freedom system in determining the separation criteria.

Scope of the theoretical study includes the development of the equations of motion of the system; the

development of the mathematical model for impending separation of the contacts; a qualitative analysis of system response; and the solution of the mathematical model for impending separation in terms of system parameters and preload.

The scope of the experimental study includes the design and construction of a large scale model of the contactor system; instrumentation of the model; testing of selected theoretical separation criteria; and investigation of system response within the unstable response regions.

### Note:

Copies of a complete report on this study are available from:

Technology Utilization Officer  
Marshall Space Flight Center  
Huntsville, Alabama 35812  
Reference: B68-10268

### Patent status:

No patent action is contemplated by NASA.

Source: Oklahoma State University  
under contract to  
Marshall Space Flight Center  
(MFS-14542)

Category 01